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**REVISITING CALENDAR ANOMALIES IN ASIAN STOCK MARKETS USING A STOCHASTIC
DOMINANCE APPROACH**

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ABSTRACT

Extensive evidence on the prevalence of calendar effects suggests that there exists abnormal returns, but some recent studies have concluded that calendar effects have largely disappeared. In spite of the non-normal nature of stock returns, most previous studies have employed the mean-variance criterion or CAPM statistics, which rely on the normality assumption and depend only on the first two moments, to test for calendar effects. A limitation of these approaches is that they miss much important information contained in the data such as higher moments. In this paper, we use the Davidson and Duclos (2000) test, which is a powerful non-parametric stochastic dominance (SD) test, to test for the existence of day-of-the-week and January effects for several Asian markets using daily data for the period from 1988 to 2002. Our empirical results support the existence of weekday and monthly seasonality effects in some Asian markets but suggest that first order SD for the January effect has largely disappeared.

KEYWORDS: Stochastic dominance, Calendar anomalies, Asian markets.

JEL CODES: C14, G12, G15

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REVISITING CALENDAR ANOMALIES IN ASIAN STOCK MARKETS USING A STOCHASTIC DOMINANCE APPROACH

I. INTRODUCTION

Extensive evidence of the day-of-the-week and January effects has been found for both the United States (US) and international stock markets (see Pettengill, 2003 for a review of the day-of-the-week effect literature). Findings from these studies suggest that investors can exploit calendar anomalies to earn abnormal returns and cast doubt on the market efficiency hypothesis. However, some recent studies, mainly using data for the 1990s, reveal a weakening and/or disappearance of calendar effects (see eg. Cheung and Coutts 1999; Davidson and Faff, 1999; Coutts and Sheikh, 2000; Gu, 2003). Most of the existing literature has employed the mean-variance (MV) criterion (Markowitz, 1952) or CAPM statistics (Sharpe, 1964; Treynor, 1965 and Jensen, 1969). Both approaches use parametric statistics which rely on the normality assumption and depend only on the first two moments to test for calendar effects. These approaches result in missing important information contained in the data such as higher moments. To overcome these limitations, some more recent studies apply a non-parametric stochastic dominance (SD) approach, which is basically free of assumption, to investigate calendar effects.

Using SD analysis, Wingender and Groff (1989) find a significant day-of-the-week effect in the US market. Seyhun (1993) finds that January returns (in almost all deciles) dominate non-January returns by first-, second-, and third-order SD, indicating the presence of a January effect in the US market. However, the SD analysis employed in these studies lacked statistical power relative to more recent SD tests developed by Anderson (1996; 2004), Davidson and Duclos (2000) and Barrett and Donald (2003). In this study, we employ the SD test proposed by Davidson and Duclos (2000) (hereafter the DD test), which is regarded to be one of the most powerful yet least conservative SD tests, to investigate the presence of day-of-the-week and January effects in Asian markets. Moreover, we apply the DD test to investigate the characteristics of the entire distribution for calendar effects, instead of only considering the mean and standard deviation which is the approach used in most of the existing literature.

Specifically, we examine the existence of day-of-the-week and January effects for the Hong Kong, Indonesian, Japanese, Malaysian, Singapore, Taiwan and Thai markets using daily data for the time period 1988 to 2002. Our objective is to test whether investors can increase their wealth as well as their utility by exploiting calendar anomalies in their portfolios. The MV criterion suggests that Monday is dominated by other weekdays and that Friday dominates other weekdays in five of the seven Asian markets. This result differs from recent studies which have found a diminishing day-of-the-week effect. Employing the DD test, we find that the day-of-the-week effect still exists in

most Asian markets and that the day-of-the-week effect is more significant than the monthly seasonality effect. This result suggests that risk-averse investors prefer other weekdays than Monday to increase their expected utility, but not their wealth. However, we also find that contrary to Seyhun's (1993) results for the US, the first order SD for the January effect has largely disappeared in Asian markets.

II. PREVIOUS STUDIES

The day-of-the-week effect was first observed by Fields (1931) who pointed out that the US stock market consistently experienced significant negative and positive returns on Mondays and Fridays respectively. Various explanations have been offered for the existence of a day-of-the-week effect (see Pettengill, 2003; Bhattacharya et al., 2003). One explanation is that institutional and individual investors have different trading patterns (Lakonishok and Maberly, 1990). Other possibilities focus on daily seasonality in the release of new information (Penman, 1987), country-specific settlement procedures (Solnik, 1990) and a spillover effect from the US or other large markets (Agarwal and Tandon, 1994). There is a large empirical literature for US equity markets which documents a day-of-the-week effect with low returns on Monday. French (1980) (S&P 500 Index); Gibbons and Hess (1981) (S&P 500 Index and CRSP value – and equally-weighted indexes for NYSE and AMEX securities); Keim and Stambaugh (1984) (S&P Index and OTC securities) and Linn and Lockwood (1988) (OTC securities) find statistically significant differences in returns across weekdays and a statistically significant negative return on Monday for a range of securities and timeframes. Lakonishok and Smidt (1988) (1897-1986), Bessembinder and Hertznel (1993) (1885-1989) and Siegel (1998) (1885-1997) find day-of-the-week effects in US equity markets using daily data for long time periods and sub-periods.

Several studies have corroborated the findings for US equity markets and other developed markets. Jaffe and Westerfield (1985) document day-of-the-week effects with significantly negative Monday returns for the Australian, Canadian, Japanese and U.K. markets. Other studies which have found day-of-the-week effects in multi-country studies for developed markets are Condoyanni et al. (1987), Dubois and Louvet (1996) and Tong (2000). However Chang et al. (1993) reach mixed conclusions on the existence of a day-of-the-week effect. These authors find evidence of a day-of-the-week effect in 13 out of 23 countries and their results are sensitive to the choice of statistical testing procedure. Davidson and Faff (1999) conclude that the day-of-the-week effect has largely disappeared in recent times in the Australian equity market.

The day-of-the-week effect has also been studied in emerging markets. Balaban (1995) documents a day-of-the-week effect in Turkey, but concludes that the effects change in direction and magnitude through time. Among studies for Asian markets, Aggarwal and Rivoli (1989) find a day-

of-the-week effect in four emerging Asian markets with strong negative returns on Monday and Tuesday. Ho (1990) finds a day-of-the-week effect in ten Asia-Pacific markets including Hong Kong, Malaysia, the Philippines, Singapore, Taiwan and Thailand. Koh and Wong (2000) find that equity markets in Hong Kong, Malaysia, the Philippines and Singapore have negative returns on Monday and Tuesday and positive returns on Wednesday to Friday. Agrawal and Tandon (1994) consider day-of-the-week effects in 18 equity markets including India, Malaysia and the Philippines for which Monday has the lowest negative return and Friday has the highest positive return. Brooks and Persaud (2001) examine day-of-the-week effects in South Korea, Malaysia, the Philippines, Taiwan and Thailand during the 1990s. Of these five markets, neither South Korea nor the Philippines display a day-of-the-week effect. Kamath et al. (1998) find persistent day-of-the-week effects for the Thai market over the period of 1980-95 which are robust to a range of statistical methodologies.

The January effect is the anomaly that common stock returns are larger in January than in other months. Several explanations have been offered for the January effect. Ogden (1990) suggests it is due to end-of-year transactions of cash or liquidity. Ritter (1988) proposes that it is due to tax-loss selling effects, while Chang and Pinegar (1990) and Kramer (1994) view the anomaly as seasonality in risk premium or expected returns. Kohers and Kohli (1992) argue that the January effect is due to the business cycle and Ligon (1997) sees the January effect as reflecting higher January trading volume and lower interest rates. Wachtel (1942) was the first to observe a January effect in the Dow Jones Industrial average for the period 1927 to 1942. The first rigorous empirical study of the January effect for US markets was made by Rozeff and Kinney (1976) who found stock returns for January to be significantly higher than the other 11 months for several indices for NYSE stocks spanning 1904 to 1974. The January effect has also been observed for a range of developed stock markets as well (see eg. Officer, 1975; Brown et al., 1983; Gultekin and Gultekin, 1983; Hillier and Marshall, 2002). However, Gu (2003) purports to find evidence of a declining January effect in US equity markets, particularly in indices containing small stocks. In terms of international markets, Coutts and Sheikh (2000) find no evidence of a January effect or monthly seasonality in the All Gold Index on the Johannesburg stock exchange for the period 1987 to 1997.

The January effect has also been studied in emerging markets. Al-Saad and Moosa (2005) find seasonality in the Kuwait Stock Exchange, which takes the form of a July effect rather than a January effect. The July effect in Kuwait is attributed to the 'summer holiday effect'. Of the studies for emerging Asian markets, Nassir and Mohammad (1987) and Pang (1988) find support for the existence of a January effect in Malaysia and Hong Kong respectively. Ho (1990) finds that six of eight emerging Asian markets exhibit a January effect. However, Cheung and Coutts (1999) find no evidence of a January effect or other monthly seasonality for the Hong Kong market.

III. DATA AND METHODOLOGY

This study uses daily stock indices for the period January 1, 1988 to December 31, 2002. The indices are the Hang Seng Index for Hong Kong, Jakarta Composite Index for Indonesia, Kuala Lumpur Composite Index for Malaysia, Nikkei Index for Japan, Straits Times Index for Singapore, Taiwan Stock Exchange Index for Taiwan and the SET Index for Thailand. All data used in this paper were obtained from Datastream. The daily log return, R_{it} , is calculated based on the closing values of the stock index i on days t and $t-1$ respectively. In our study for the day-of-the-week effect, we exclude any week with fewer than five trading days. This is consistent with the study by Wingender and Groff (1989) and is, in principle, consistent with the approach in previous studies on the day-of-the-week effect. Similarly, in our test for the January effect, we only examine returns for the first twenty calendar days so as to fulfil the requirement of equal sample size. The portfolio of each weekday (month) is formed by grouping the returns of the same weekday (month) over our entire sample period. Following this, a pairwise comparison is done using the SD approach for all portfolios in the study.

The commonly used techniques in the comparison of prospects are the MV model developed by Markowitz (1952) and the capital asset pricing model (CAPM) developed by Sharpe (1964), Treynor (1965) and Jensen (1969). For any two investments with variables for profit and return Y_i and Y_j with means μ_i and μ_j and standard deviations σ_i and σ_j respectively, Y_j is said to dominate Y_i by the MV criterion if $\mu_j \geq \mu_i$ and $\sigma_j \leq \sigma_i$. The MV criterion and CAPM depend on the existence of normal return distributions and quadratic utility functions, and are not appropriate if return distributions are not normal, or if investors' utility functions are not quadratic.

The SD approach differs from traditional parametric approaches in that comparing portfolios using the SD approach is equivalent to the choice of assets by utility maximization. It endorses the minimum assumptions of the investor's utility function and studies the entire distribution of returns directly. The advantage of SD analysis over parametric tests becomes apparent when the stock return distribution is non-normal as the SD approach does not require any assumptions about the nature of the distribution and therefore it can be used for any type of distribution. In addition, SD, revealing the entire distribution, recovers all information from the distribution while traditional parametric tests, depending on the mean and variance, omit all information from higher moments. As such, the SD approach is superior and less restrictive than the traditional parametric statistics for analysing investment decision-making under uncertainty. For this reason the SD approach has

become popular in recent empirical applications in finance theory (see eg. Larsen and Resnick, 1999; Powers and Tzeng, 2001; Kjetsaa and Kieff, 2003; Post and Levy, 2005; Wong *et al.*, 2005; and Fong *et al.*, 2005).

The most common SD rules are first order SD (FSD), second order SD (SSD) and third-order SD (TSD). Letting $F_0 = f$ and $G_0 = g$ be the probability density functions (PDF) and $F_1 = F$ and $G_1 = G$ be the cumulative distribution functions (CDF) of returns for two portfolios X and Y respectively, we can define:

$$H_j^A(x) = \int_a^x H_{j-1}^A(t) dt \text{ for } h = f, g, H = F, G, \text{ and } j = 1, 2, 3. \quad (1)$$

The three basic SD rules (see, eg. Hadar and Russell, 1969; Whitmore, 1970) are:

Portfolio X dominates portfolio Y by FSD, denoted $X \succ_1 Y$ or $F \succ_1 G$, if and only if $F_1(x) \leq G_1(x)$ for all possible returns, x , with strict inequality for at least one value of x .

Portfolio X dominates portfolio Y by SSD, denoted $X \succ_2 Y$ or $F \succ_2 G$, if and only if $F_2(x) \leq G_2(x)$ for all possible returns, x , with strict inequality for at least one value of x .

Portfolio X dominates portfolio Y by TSD, denoted $X \succ_3 Y$ or $F \succ_3 G$, if, and only if, $\mu_F \geq \mu_G$ and $F_3(x) \leq G_3(x)$ for all possible returns, x , with strict inequality for at least one value of x .

Let U be the utility function. Investigating SD among different investments is equivalent to examining the choice of investments by utility maximization (see, eg. Quirk and Saposnik, 1962; Fishburn, 1964; Hanoch and Levy, 1969; and Jarrow, 1986):

Theorem 1:

All non-satiated investors (prefer more to less) with utility functions $U'(x) \geq 0$ will prefer X to Y , and will increase their wealth and utility by shifting their investments from Y to X , if and only if $X \succ_1 Y$.

All non-satiated and risk-averse investors with utility functions $U'(x) \geq 0$ and $U''(x) \leq 0$ will prefer X to Y , and will increase their utility by shifting their investments from Y to X , if and only if $X \succ_2 Y$.

All non-satiated and risk-averse investors with decreasing absolute risk aversion, such that utility functions $U'(x) \geq 0$, $U''(x) \leq 0$ and $U'''(x) \geq 0$ (prefer positive skewness), will prefer X to Y and will increase their utility by shifting their investments from Y to X , if and only if $X \succ_3 Y$.

SD implies a hierarchy: FSD implies SSD, which in turn implies TSD. However, the reverse is not true and, as such, we traditionally only report the lowest dominance order.

IV. THE DAVIDSON AND DUCLOS (2000) TEST

As shown in Tse and Zhang (2004) and Lean *et al.* (2004), the DD test is one of the most powerful and simplest yet least conservative SD test statistics. Let $\{m_i\}$, $i = 1, 2, \dots, N$ be the sample of returns drawn from a population of Monday (or January) portfolios with cumulative distribution function $FM(\cdot)$. Without loss of generality, assume that all CDFs have common support $[a, b]$ where $a < b$. For any $a \leq x \leq b$, we define

$$D_M^1(x) = F_M(x),$$

$$D_M^s(x) = \int_a^x D_M^{s-1}(u) du, \text{ for any integer } s \geq 2.$$

Let $\{o_i\}$, $i = 1, 2, \dots, N$ be a sample of returns drawn from the population of non-Monday (or non-January) portfolios with cumulative distribution function $FO(\cdot)$. $D_O^s(x)$ is then constructed analogously. For a grid of pre-selected points x_1, x_2, \dots, x_k , the DD statistic is:

$$T^s(x) = \frac{\hat{D}_M^s(x) - \hat{D}_O^s(x)}{\sqrt{\hat{V}^s(x)}} \text{ for } s = 1, 2 \text{ and } 3;$$

where

$$\hat{D}_M^s(x) = \frac{1}{N(s-1)!} \sum_{i=1}^N (x - y_i)_+^{s-1},$$

$$\hat{D}_O^s(x) = \frac{1}{N(s-1)!} \sum_{i=1}^N (x - z_i)_+^{s-1},$$

$$\hat{V}_M^s(x) = \frac{1}{N} \left[\frac{1}{N((s-1)!)^2} \sum_{i=1}^N (x - y_i)_+^{2(s-1)} - \hat{D}_M^s(x)^2 \right],$$

$$\hat{V}_O^s(x) = \frac{1}{N} \left[\frac{1}{N((s-1)!)^2} \sum_{i=1}^N (x - z_i)_+^{2(s-1)} - \hat{D}_O^s(x)^2 \right],$$

$$\hat{V}_{M,O}^s(x) = \frac{1}{N} \left[\frac{1}{N((s-1)!)^2} \sum_{i=1}^N (x - y_i)_+^{s-1} (x - z_i)_+^{s-1} - \hat{D}_M^s(x) \hat{D}_O^s(x) \right],$$

$$\hat{V}^s(x) = \hat{V}_M^s(x) + \hat{V}_O^s(x) - 2\hat{V}_{M,O}^s(x).$$

Because it is empirically impossible to test the null hypothesis on the full support of the distributions, following the approach proposed by Bishop *et al.* (1992), we test only a pre-designed finite number of values x for the following hypotheses:

$$\begin{aligned} H_0 &: D_M^s(x_i) = D_O^s(x_i), \text{ for all } x_i, \\ H_A &: D_M^s(x_i) \neq D_O^s(x_i), \text{ for some } x_i, \\ H_{A1} &: D_M^s(x_i) \leq D_O^s(x_i) \text{ for all } x_i, D_M^s(x_i) < D_O^s(x_i) \text{ for some } x_i; \\ H_{A2} &: D_M^s(x_i) \geq D_O^s(x_i) \text{ for all } x_i, D_M^s(x_i) > D_O^s(x_i) \text{ for some } x_i. \end{aligned}$$

In the above hypotheses, H_A is set to be exclusive of both H_{A1} and H_{A2} , which means that, if the test accepts H_{A1} or H_{A2} , it will not be classified as H_A . We also note that H_{A1} is equivalent to $H_{A1}' : M \succ_s O$ and H_{A2} is equivalent to $H_{A2}' : O \succ_s M$. Under the null hypothesis, Davidson and Duclos (2000) show that $T^s(x)$ is asymptotically distributed as the Studentized Maximum Modulus (SMM) distribution (Richmond 1982) to account for joint test size. To implement the DD test, a t-statistic at each grid point is computed and the null hypothesis H_0 is rejected if the largest t-statistic is significant. The SMM distribution with degrees of freedom denoted by $M_{\infty, \alpha}^k$ is used to control for the probability of rejecting the overall null hypothesis. The following decision rules are based on $1-\alpha$ percentile of $M_{\infty, \alpha}^k$ tabulated by Stoline and Ury (1979):

1. If $|T^s(x_i)| < M_{\infty, \alpha}^k$ for $i = 1, \dots, k$ accept H_0 .
2. If $T^s(x_i) < M_{\infty, \alpha}^k$ for all i and $-T^s(x_i) > M_{\infty, \alpha}^k$ for some i accept H_{A1} .
3. If $-T^s(x_i) < M_{\infty, \alpha}^k$ for all i and $T^s(x_i) > M_{\infty, \alpha}^k$ for some i accept H_{A2} .
4. If $T^s(x_i) > M_{\infty, \alpha}^k$ for some i and $-T^s(x_i) > M_{\infty, \alpha}^k$ for some i accept H_A .

If H_0 or H_A is accepted, there is no SD of one particular weekday (month) over another. This implies that it is impossible to create any arbitrage opportunity or to increase utility/wealth by exploiting calendar anomalies. On the other hand, if H_{A1} or H_{A2} is accepted for order one, a particular weekday (month) stochastically dominates the other weekday (month) at the first order and in this situation, arbitrage opportunities exist and exploiting this calendar effect will increase investors' wealth and utility. If H_{A1} or H_{A2} is accepted for order two or three, a particular weekday (month) stochastically dominates the other weekday (month) at the second or third order and in this situation, arbitrage opportunities do not exist and exploiting this calendar effect will only increase investors' utility, not wealth (see eg. Jarrow, 1986; Falk and Levy, 1989).

Based on the findings in Tse and Zhang (2004) and Lean *et al.* (2004), the DD test works well for 10 grid points. Too few grids will miss information on the distributions between any two consecutive grids (Barrett and Donald, 2003), and too many grids will violate the independence assumption required by the SMM distribution (Richmond (1982). In order to make more detailed comparisons without violating the independence assumption, we follow Fong *et al.* (2005) and make 10 major partitions with 10 minor partitions within any two consecutive major partitions in each comparison, and show the statistical inference based on the SMM distribution for $k=10$ and infinite degrees of freedom. This allows us to examine for consistency in both the magnitude and sign of the DD statistics between any two consecutive major partitions. The critical value of SMM (M) for $n = \infty$ and $k = 10$ at the 5 percent level is 3.254.

V. RESULTS

Day-of-the-Week Effect

Table 1 presents the mean return, standard deviation, skewness, kurtosis and Kolmogorov-Smirnov (K-S) test statistic of the returns for each day of the week and for each country. It shows a tendency for the lowest mean return to be on Monday (though not necessarily significant) to the highest mean return on Friday, consistent with most previous studies for the day-of-the-week effect. In contrast to the mean returns, the standard deviation of returns generally decrease as the week progresses as the volatility tends to be highest on Monday and lowest on Friday in all countries except Indonesia. While not reported, pairwise t-tests indicated that some weekdays (months) have statistically significantly higher mean returns than others, and the F-statistic also showed some standard deviations are significantly different at the 5% level.

Insert Table 1

While we are primarily interested in the results of the DD test, for comparative purposes, we first applied the MV criterion. Applying the MV criterion, the results in Table 1 show that Monday is dominated by other weekdays while Friday dominates other weekdays in five out of seven Asian markets. The two countries for which there are no day-of-the-week effects are Indonesia and Taiwan. Taking Hong Kong as an example, from Table 1, it can be seen that in Hong Kong, Monday's mean return is -0.0801%, which is lower than all other weekdays (significant at 10% except Tuesday and Thursday) and its standard deviation is 2.15%, which is significantly higher than all other weekdays. Hence, applying the MV criterion, Monday is dominated by Wednesday and Friday. On the other hand, Friday's mean return is 0.1054%, which is higher than returns on Monday and Thursday (significant at 10%) and Tuesday (not significant) and its standard deviation

is 1.51%, which is lower than these two weekdays. Thus, we conclude that Friday dominates Monday and Thursday for Hong Kong. Overall, the findings from the MV criteria for five of the seven countries are inconsistent with a diminishing weekday effect suggested by recent studies.

However, as discussed earlier, if normality does not hold, the MV rule may lead to paradoxical results. Table 1 shows that weekday returns in the Asian countries under consideration in this study are non-normal, as evidenced by the highly significant K-S statistics. Moreover, on the basis of the findings using the MV criterion, we cannot conclude whether the investor's preference between portfolios will lead to an increase in wealth or, in the case of risk-averse individuals, whether their preference will increase their utility without an increase in wealth. The SD approach can be used for this purpose. To demonstrate the use of the SD approach, we plot the CDFs of Monday and Friday returns and their DD statistics of the first three orders in Figure 1 for Indonesia and Figure 2 for Malaysia. The CDF plots show that there is no FSD between the Monday and Friday stock returns for Indonesia as their CDFs touch. For Malaysia, the CDF plot for Friday is below that of Monday, meaning that Friday FSD Monday.

 Insert Figs. 1 & 2 here

To verify this inference formally, we apply the DD test to the series. Recall that the DD test rejects the null hypothesis if none of the DD statistics is significantly positive and at least one of the DD statistics are significantly negative (Davidson and Duclos, 2000). In some situations, X dominates Y in a small range, but most risk-averse individuals prefer Y to X . In this case, it is said that Y almost stochastically dominates X (Leshno and Levy, 2002). Thus, these DD test decision rules are too restrictive. To minimize a type II error of finding dominance when there is none, and to take care of the almost SD effect, a conservative 5% cut-off point is used in this study. Using a 5% cut-off point, a particular weekday (month) is said to dominate the other if at least 5% of the DD statistics are significantly negative and no DD statistics are significantly positive.

Figures 1 and 2 show the values of the DD statistics over the entire distribution of returns in Indonesia and Malaysia respectively. These figures give a visual representation of the DD test results. The plots show that, in general, T_1 moves from negative to positive along the distribution of returns. This implies that Friday dominates Monday in the lower range of returns (negative returns) while Monday dominates Friday in the upper range (positive returns). However, the difference could be significant or insignificant. From the figures, we found that no T_1 is significantly negative and positive for Indonesia while 10% of T_1 is significantly negative and no T_1 is significantly positive for Malaysia. All T_2 and T_3 are negative along the distribution of returns. Most are found to be significant at the 5% level for Malaysia (50%-SSD, 63%-TSD) but not for Indonesia (0%-SSD,

0%-TSD). Thus, we conclude that Friday dominates Monday for the first three orders for Malaysia but not for Indonesia at the 5% SMM significant level. This infers that any risk-averse investor will prefer Friday to Monday in the Malaysian stock market as they will increase their wealth as well as their expected utility by switching their investments from Monday to Friday.

 Insert Table 2

Table 2 shows the dominance among different weekday returns for each country in our study using the DD test. Our results show that Monday stock returns are stochastically dominated by at least one of the other weekday returns at the first-order in all countries except Indonesia and Taiwan. For example, Tuesday returns FSD Monday returns in Hong Kong, Japan and Singapore; Friday returns FSD Monday returns in Malaysia, Singapore and Thailand; Thursday returns FSD Monday returns in Singapore and Wednesday returns FSD Monday returns in Thailand. This implies that all non-satiated investors would prefer to sell stocks on at least one of the other weekdays and buy stocks on Monday and there may exist an arbitrage opportunity as all investors will increase their wealth and utility by so doing (Bawa, 1978; Jarrow, 1986; and Falk and Levy, 1989). This implies that no asset pricing models would be able to rationalize the exceptionally high returns of other weekdays in terms of risk compensation.

Moreover, our results also show that Friday returns FSD both Tuesday and Thursday returns in Thailand. Monday returns are stochastically dominated by Thursday returns in Japan and dominated by Wednesday returns in Malaysia and Singapore at second- and third-order. Moreover, Monday returns are dominated by all other weekdays by SSD and TSD in Taiwan. Thus, we conclude that there is a day-of-the-week effect in some Asian markets and hence investors can increase their wealth and/or utility by exploiting the existence of this calendar effect. In addition, from the SSD and TSD results, we can infer that risk-averse individuals would prefer (or not prefer) certain weekdays in some of the Asian markets and that they could increase their utilities, but not their wealth, by exploiting this calendar effect for the entire sample period.

January Effect

Table 3 shows that January returns are positive in all Asian countries for our sample except Hong Kong. But January does not have the highest returns of the month (except in Japan and Thailand) and Hong Kong even has the lowest returns in January. Table 4 reports the DD test results for January returns with each of the non-January months for the whole sample period. Contrary to Seyhun's (1993) results, we find that July returns FSD January returns in Hong Kong. This implies that there might be arbitrage opportunities to increase the wealth and utility of non-satiated

investors in Hong Kong if they sell stocks in July and buy stocks in January. January returns are dominated by July, November and December at second- and third-order in Singapore. Risk-averse investors in Singapore prefer July, November and December returns to January returns for their utility maximization. For all the other Asian markets, the January returns do not dominate any of the non-January months and vice-versa by FSD, SSD or TSD. Thus, we conclude that there is no arbitrage opportunity due to a monthly seasonality effect in the Asian markets except in Hong Kong. The disappearance of a January effect is probably due to investors becoming more aware of this anomaly and indeed timing their trades such that it has been priced away. Thus, our results suggest that investors in Asian markets can no longer make abnormal returns by capitalizing on a January effect.

Insert Tables 3 and 4

VI. CONCLUSIONS

As discussed earlier, some relatively recent studies have suggested a weakening and/or disappearance of the day-of-the-week effect in non-US markets over the course of the 1990s. However, these findings are still tentative, due to the differing statistical tools used in the studies, some of which may have been mis-specified or suffer serious measurement problems. As stock returns in Asian markets are not normally distributed by nature, the parametric MV approach is of limited value. Another limitation is that findings using the MV approach cannot be used to conclude whether investors' portfolio preferences will increase wealth or, in the case of risk-averse investors, lead to an increase in utility without an increase in wealth. Thus, this study has used the SD approach, which is not distribution-dependent and can shed light on the utility and wealth implications of portfolio preferences through exploiting information in higher order moments to test for day-of-the-week and January effects in Asian markets.

Our objective was to test whether investors can maximize their expected utility by exploiting calendar anomalies in their portfolios. In addition to examining whether investors can exploit abnormalities in the market, our results also have important implications for stock market efficiency. If stock markets function efficiently, there should not be any day-of-the-week or January effect. The findings that Monday returns are dominated by other weekdays and Friday dominates other weekdays, applying the MV criterion, suggests that the diminishing of weekday effect claimed by recent studies is not correct. Our DD test results for the day-of-the-week effect also

indicate there is FSD of other weekdays over Monday returns in the Asian countries studied. Moreover, the existence of SSD and TSD in some of the markets suggests that risk-averse individuals would prefer (or not prefer) certain weekday in some of the Asian markets to maximize their expected utility. On the other hand, the DD test results for the January effect suggest that the January effect has largely disappeared from Asian markets and that only in Singapore is January dominated by some other months at SSD and TSD. The reason for the re-appearance of the day-of-the-week and disappearance of the January effects from Asian markets is an interesting topic for future research.

REFERENCES

- Aggarwal, R. and P. Rivoli (1989) "Seasonal and Day-of-the-Week Effects in Four Emerging Markets", *Financial Review*, **24**, 541-550.
- Agrawal, A. and K. Tandon (1994) "Anomalies or Illusions? Evidence From Stock Markets in Eighteen Countries", *Journal of International Money and Finance*, **14**, 83-106.
- Al-Saad, K. and I.A. Moosa (2005) "Seasonality in Stock Returns: Evidence From an Emerging Market", *Applied Financial Economics*, **15**, 63-71.
- Anderson, G. (1996) "Nonparametric Tests of Stochastic Dominance in Income Distributions", *Econometrica* **64**, 1183 – 1193.
- Anderson, G. (2004) "Toward an Empirical Analysis of Polarization", *Journal of Econometrics* **122**, 1-26.
- Balaban, E. (1995) "Day of the Week Effects: New Evidence from an Emerging Market", *Applied Economics Letters*, **2**, 139-143.
- Barrett, G. and S. Donald (2003) "Consistent Tests for Stochastic Dominance", *Econometrica* **71**, 71-104.
- Bawa, V. S. (1978) "Safety-First, Stochastic Dominance, and Optimal Portfolio Choice", *Journal of Financial and Quantitative Analysis*, **13**, 255-271.
- Bessembinder, H. and M. Hertzel (1993) "Return Autocorrelation Around Nontrading Days", *Review of Financial Studies*, Spring, 155-189.
- Bhattacharya, K., N. Sarkar and D. Mukhopadhyay (2003) "Stability of the Day of the Week Effect in Return and in Volatility at the Indian Capital Market: A GARCH Approach with Proper Mean Specification", *Applied Financial Economics*, **13**, 553-563.
- Bishop, J.A., J.P. Formly, and P.D. Thistle (1992) "Convergence of the South and Non-South Income Distributions." *American Economic Review*, **82**, 262-272.
- Brooks, C. and G. Persaud (2001) "Seasonality in Southeast Asian Stock Markets: Some New Evidence on Day of the Week Effects", *Applied Economics Letters*, **8**, 155-158.
- Brown, P., Keim, D., Kleidon, A., and Marsh, T. (1983) "Stock Return Seasonalities and Tax-loss Selling Hypothesis – Analysis of the Arguments and Australian Evidence", *Journal of Financial Economics*, **12**, 105-127.
- Chang, E.C. and L.M. Pinegar (1990) "Stock Market Seasonal and Prespecified Multifactor Pricing Relations", *Journal of Financial and Quantitative Analysis*, **25**, 517-533.
- Chang, E.C., L.M. Pinegar and R. Ravichandran (1993) "International Evidence on the Robustness of the Day of the Week Effect", *Journal of Financial and Quantitative Analysis*, **28**, 497-513.

- Cheung, K.C. and J.A. Coutts (1999) "The January Effect and Monthly Seasonality in the Hang Seng Index: 1985-97", *Applied Economics Letters*, **5**, 121-123.
- Condoyanni I., J. O'Hanlon and C. Ward (1987) "Day of the Week Effects on Stock Returns: International Evidence", *Journal of Business Finance and Accounting*, Summer, 159-74.
- Coutts, J.A. and M.A. Sheikh (2000) "The January Effect and Monthly Seasonality in the All Gold Index on the Johannesburg Stock Exchange 1987-1997", *Applied Economics Letters*, **7**, 489-492.
- Davidson, R., and J-Y Duclos (2000) "Statistical Inference for Stochastic Dominance and for the Measurement of Poverty and Inequality", *Econometrica*, **68**, 1435-1464.
- Davidson, S., and R. Faff (1999) "Some Additional Australian Evidence on the Day-of-the-week Effect", *Applied Economics Letter*, **6**, 247-249.
- Dubois, M. and P. Louvet (1996) "The Day of the Week Effect: The International Evidence", *Journal of Banking and Finance*, November, 1463-84.
- Falk, H., and H. Levy (1989) "Market Reaction to Quarterly Earnings' Announcements: A Stochastic Dominance Based Test of Market Efficiency", *Management Science*, **35**, 425-446.
- Fields, M.J. (1931) "Stock Prices: A Problem in Verification", *Journal of Business*, **7**, 415-418.
- Fishburn, P.C. (1964) *Decision and Value Theory*, (New York: McGraw Hill)..
- Fong, W.M., W.K. Wong and H.H. Lean (2005) "International Momentum Strategies: A Stochastic Dominance Approach", *Journal of Financial Markets*, **8**, 89–109.
- French, K. R. (1980) "Stock Returns and the Weekend Effect", *Journal of Financial Economics*, **8**, 55-69.
- Gibbons, M.R. and P.J. Hess (1981) "Day of the Week Effects and Asset Returns", *Journal of Business*, **54**, 579-596.
- Gu, A.Y. (2003) "The Declining January Effect: Evidence from U.S. Equity Markets", *The Quarterly Review of Economics and Finance*, **43**, 395-404.
- Gultekin, M. N., and N. B. Gultekin (1983) "Stock Market Seasonality: International Evidence", *Journal of Financial Economics*, **12**, 469-481.
- Hadar J., and W.R. Russell (1969) "Rules for Ordering Uncertain Prospects", *American Economic Review*, **59**, 25-34.

- Hanoch G., and H. Levy (1969) "The Efficiency Analysis of Choices Involving Risk", *Review of Economic Studies*, **36**, 335-346.
- Hillier, D. and Marshall, A. (2002) "Insider Trading, Tax-loss Selling and Turn of the Year Effect", *International Review of Financial Analysis*, **11**, 73-84.
- Ho, Y.K. (1990) "Stock Return Seasonalities in Asia-Pacific Markets", *Journal of International Financial Management and Accounting*, **2**, 47-77.
- Jaffe, J. and R. Westerfield (1985) "The Weekend Effect in Common Stock Returns: The International Evidence", *Journal of Finance*, **40**, 433-54.
- Jarrow, R. (1986) "The Relationship between Arbitrage and First Order Stochastic Dominance", *Journal of Finance*, **41**, 915-921.
- Jensen, M.C. (1969) "Risk, The Pricing of Capital Assets and the Evaluation of Investment Portfolios", *Journal of Business*, **42**, 167-247.
- Kamath, R.R., R. Chakornpipat and A. Chatrath (1998) "Return Distributions and the Day-of-the-week Effects in the Stock Exchange of Thailand", *Journal of Economics and Finance*, **22**, 97-106.
- Keim, D.B. and R. Stambaugh (1984) "A Further Investigation of the Weekend Effect in Stock Returns", *Journal of Finance*, **39**, 819-835.
- Kjetsaa R., and M. Kieff (2003) "Stochastic Dominance Analysis of Equity Mutual Fund Performance", *American Business Review*, **21**, 1-8.
- Koh, S.K. and K.A. Wong (2000) "Anomalies in Asian Emerging Stock Markets" in D.B. Keim and W.T. Zimba (Eds.) *Security Market Imperfections in World Wide Equity Markets* (Cambridge: Cambridge University Press).
- Kohers, T. and R.K. Kohli (1992) "The Yearend Effect in Stock Returns Over Business Cycles: A Technical Note", *Journal of Economics and Finance*, **16**, 61-88.
- Kramer, C. (1994) "Macroeconomic Seasonality and the January Effect", *Journal of Finance*, **49**, 1883-1891.
- Lakonishok, J. and E. Maberly (1990) "The Weekend Effect: Trading Patterns of Individual and Institutional Investors", *Journal of Finance*, **45**, 231-243.
- Lakonishok, J. and S. Smidt (1988) "Are Seasonal Anomalies Real? A Ninety Year Perspective", *Review of Financial Studies*, Winter, 403-25.
- Larsen G.A., and B.G. Resnick (1999) "A Performance Comparison between Cross-sectional Stochastic Dominance and Traditional Event Study Methodologies", *Review of Quantitative Finance and Accounting*, **12**, 103-112.

- Lean, H.H., W.K. Wong, and X. Zhang (2004) "Size and Power of Some Stochastic Dominance Tests", Working Paper, National University of Singapore.
- Leshno, M., and H. Levy (2002) "Preferred by "All" and Preferred by "Most" Decision Makers: Almost Stochastic Dominance", *Management Science*, **48**, 1074-1085.
- Ligon, J. (1997) "A Simultaneous Test of Competing Theories Regarding the January Effect", *Journal of Financial Research*, **20**, 13-32.
- Linn, S. and L. Lockwood (1988) "Short-Term Stock Price Patterns: NYSE, AMEX, OTC", *Journal of Portfolio Management*, Winter, 30-34.
- Markowitz, H. (1952) "Portfolio Selection", *Journal of Finance*, **7**, 77-91.
- Nassir, A. and S. Mohammad (1987) "The January Effect of Stock Traded on the Kuala Lumpur Stock Exchange: An Empirical Analysis", *Hong Kong Journal of Business Management*, **5**, 33-50.
- Ogden, J.P. (1990) "Turn of the Month Evaluations of Liquid Profits and Stock Returns: A Common Explanation for the Monthly and January Effects", *Journal of Finance*, **45**, 1259-1272.
- Officer, R. (1975) "Seasonality in Australian Capital Markets – Market Efficiency and Empirical Issues", *Journal of Financial Economics*, **2**, 29-51.
- Pang, Q.K.L. (1988) "An Analysis of Hong Kong Stock Return Seasonality and Firm Size Anomalies for the Period 1977 to 1986", *Hong Kong Journal of Business Management*, **6**, 69-90.
- Penman, S.H. (1987) "The Distribution of Earning News Over Time and Seasonalities in Aggregate Stock Returns", *Journal of Financial Economics*, **18**, 199-228.
- Pettengill, G.N. (2003) "A Survey of the Monday Effect Literature", *Quarterly Journal of Business and Economics*, **42**, 3-37.
- Post, T., and H. Levy (2005) "Does Risk Seeking Drive Asset Prices?" *Review of Financial Studies* (forthcoming).
- Powers, M.R., and L.Y. Tzeng (2001) "Risk Transformations, Deductibles, and Policy Limits", *Journal of Risk and Insurance*, **68**, 465-473.
- Quirk J.P., and R. Saposnik (1962) "Admissibility and Measurable Utility Functions", *Review of Economic Studies*, **29**, 140-146.
- Richmond, J. (1982) "A General Method for Constructing Simultaneous Confidence Intervals", *Journal of the American Statistical Association*, **77**, 455-460.
- Ritter, J.R. (1988) "The Buying and Selling Behavior of Individual Investors at the Turn of the Year", *Journal of Finance*, **43**, 701-717.

- Rozeff, M. S., and W. R. Kinney (1976) "Capital Market Seasonality: The Case of Stock Returns", *Journal of Financial Economics*, **3**, 379-402.
- Sharpe, W.F. (1964) "Capital Asset Prices: Theory of Market Equilibrium Under Conditions of Risk", *Journal of Finance* **19**, 452-442.
- Seyhun, H. N. (1993) "Can Omitted Risk Factors Explain the January Effect? A Stochastic Dominance Approach", *Journal of Financial and Quantitative Analysis*, **28**, 195-212.
- Siegel, J. (1998) *Stocks for the :Long Run* (New York: McGraw Hill).
- Solnik, B. (1990) "The Distribution of Daily Stock Returns and Settlement Procedures: The Paris Bourse", *Journal of Finance*, **45**, 1601-10.
- Stoline, M.R. and H.K. Ury (1979) "Tables of the Studentized Maximum Modulus Distribution and an Application to Multiple Comparisons among Means", *Technometrics*, **21**, 87-93.
- Tong, W. (2000) "International Evidence on Weekend Anomalies", *Journal of Financial Research*, Winter, 495-522.
- Treynor, J.L. (1965) "How to rate management of investment funds", *Harvard Business Review* **43**, 63-75.
- Tse, Y.K., and X. Zhang (2004) "A Monte Carlo Investigation of Some Tests for Stochastic Dominance", *Journal of Statistical Computation and Simulation*, **74**, 361-378.
- Wachtel, S.B. (1942) "Certain Observation on Seasonal Movement in Stock Prices", *Journal of Business*, **15**, 184-193.
- Wingender, J., and J. Groff (1989) "On Stochastic Dominance Analysis of Day-of-the-Week Return Patterns", *The Journal of Financial Research*, **12**, 51-55.
- Whitmore G.A. (1970) "Third-degree Stochastic Dominance", *American Economic Review*, **60**, 457-459.
- Wong, W. K., H.E. Thompson, S. Wei and Y. F. Chow (2005) "Do Winners perform better than Losers? A Stochastic Dominance Approach", *Advances in Quantitative Analysis of Finance and Accounting* (forthcoming).

Table 1: Summary Statistics of Weekday Returns for Asian Countries (1988-2002)

	Mon	Tue	Wed	Thu	Fri
HONG KONG					
Mean (%)	-0.0801	0.0944 ^c	0.1148 ^c	-0.0567	0.1054 ^c
Std Dev (%)	2.15	1.48	1.78	1.61	1.51
Skewness	-2.41	-0.92	1.01	-0.89	0.71
Kurtosis	29.31	17.59	14.68	5.75	4.29
K-S ^a	0.14	0.08	0.10	0.09	0.08
Taiwan					
Mean (%)	0.0816	-0.1152	0.0013	0.0223	0.0983
Std Dev (%)	2.62	1.87	1.93	1.96	1.90
Skewness	0.13	0.19	-0.26	-0.31	-0.17
Kurtosis	2.45	2.71	1.45	2.21	1.90
K-S ^a	0.06	0.11	0.06	0.09	0.07
Japan					
Mean (%)	-0.1736 ^a	0.0382	0.0208	0.0189	-0.0654
Std Dev (%)	1.60	1.35	1.46	1.37	1.41
Skewness	-0.07	1.04	0.21	-0.04	0.35
Kurtosis	2.97	10.93	2.81	2.35	3.40
K-S ^a	0.08	0.07	0.07	0.07	0.08
Malaysia					
Mean (%)	-0.1720 ^a	0.0250	0.1008 ^c	0.0099	0.1020 ^c
Std Dev (%)	1.88	1.83	1.42	1.43	1.36
Skewness	1.85	-1.30	0.52	-1.11	1.13
Kurtosis	26.28	69.33	8.94	10.42	13.97
K-S ^a	0.13	0.16	0.09	0.10	0.10
Singapore					
Mean (%)	-0.1477 ^b	0.0055	0.0597	0.0548	0.0916 ^c
Std Dev (%)	1.72	1.23	1.31	1.25	1.22
Skewness	0.34	0.21	-0.13	-0.12	0.32
Kurtosis	13.72	11.35	5.34	4.77	6.95
K-S ^a	0.12	0.09	0.08	0.07	0.07
Indonesia					
Mean (%)	-0.0047	-0.0340	0.0015	0.1027	0.1538 ^c
Std Dev (%)	1.78	1.42	1.73	1.84	2.14

Skewness	1.93	0.31	0.75	1.24	9.92
Kurtosis	24.14	9.81	18.34	28.51	184.96
K-S ^a	0.16	0.13	0.13	0.16	0.21

Thailand

Mean (%)	-0.2333 ^a	-0.0860	0.0936	-0.0016	0.2430 ^a
Std Dev (%)	1.95	1.75	1.82	1.77	1.64
Skewness	0.43	0.12	-0.52	0.31	0.86
Kurtosis	5.03	6.21	3.42	4.76	6.52
K-S ^a	0.12	0.09	0.07	0.08	0.10

^{a, b, c} denote significance at the 1%, 5% and 10% level respectively.

Figure 1: CDF and DD Statistics of Monday and Friday Returns of Indonesia

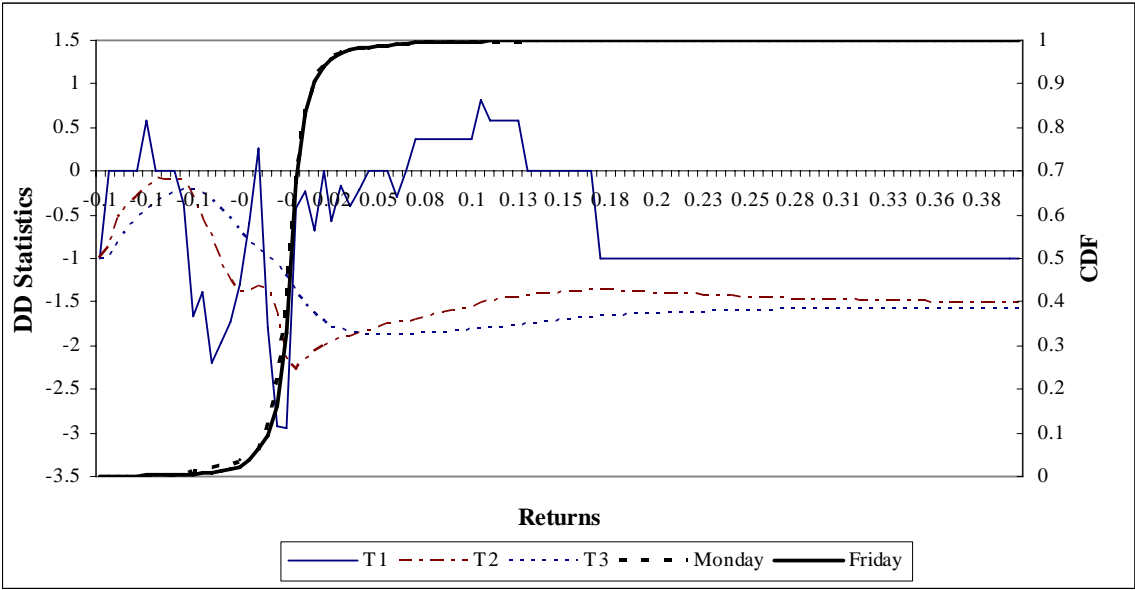


Figure 2: CDF and DD Statistics of Monday and Friday Returns of Malaysia

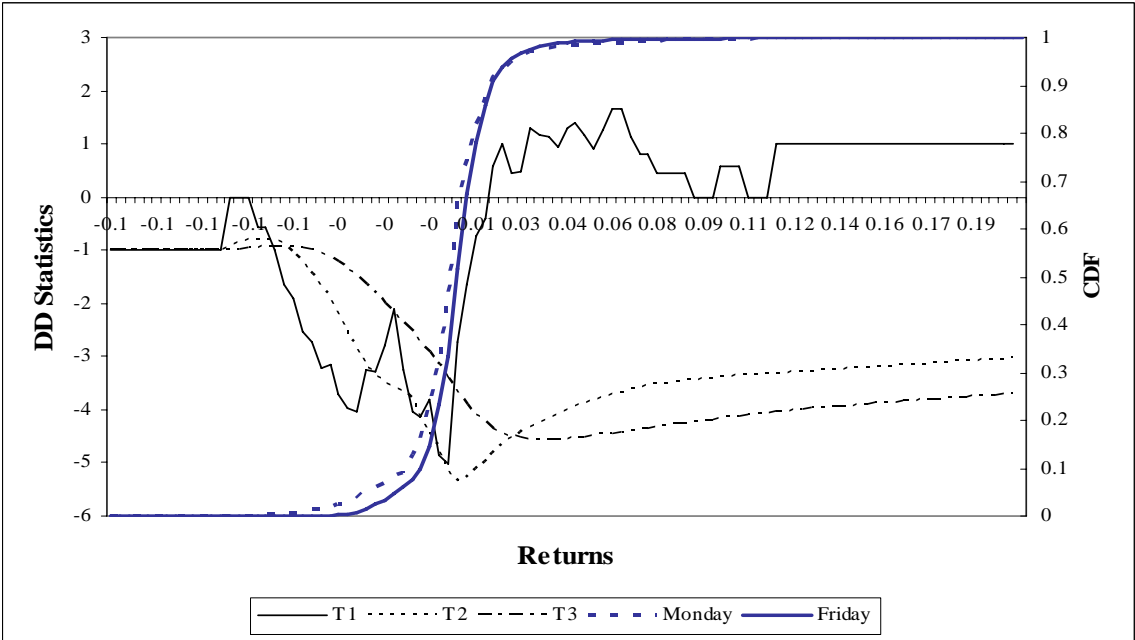


Table 2: DD Test Results of Weekday Returns for Asian Countries (1988-2002)

Hong Kong	Tue $>_1$ Mon	-	-	-
Taiwan	Tue $>_2$ Mon	Wed $>_2$ Mon	Thu $>_2$ Mon	Fri $>_2$ Mon
Japan	Tue $>_1$ Mon	Thu $>_2$ Mon	-	-
Malaysia	Wed $>_2$ Mon	Fri $>_1$ Mon	-	-
Singapore	Tue $>_1$ Mon	Wed $>_2$ Mon	Thu $>_1$ Mon	Fri $>_1$ Mon
Indonesia	-	-	-	-
Thailand	Wed $>_1$ Mon	Fri $>_1$ Mon	Fri $>_1$ Tue	Fri $>_1$ Thu

Note: - denotes FSD, SSD & TSD do not exist; $X >_1 Y$ is X dominates Y at FSD, SSD & TSD; $X >_2 Y$ is X dominates Y at SSD & TSD.

Table 3: Mean of Returns for Each Month (1988-2002)

	Hong Kong	Taiwan	Japan	Malaysia	Singapore	Indonesia	Thailand
January	-0.0097	0.2258	0.1122	0.0502	0.0700	0.1877	0.2685
February	0.2586	0.3400	0.0325	0.2406	0.0924	0.0017	-0.0351
March	-0.0169	0.0613	-0.0314	-0.0674	-0.0592	0.0711	-0.0565
April	0.0902	0.0206	0.0683	0.0780	0.1396	0.0191	0.1225
May	0.0630	-0.1205	0.0105	0.0224	-0.0184	0.1838	-0.0841
June	-0.0082	-0.0546	-0.0535	-0.0168	-0.0013	0.0728	0.0409
July	0.0781	0.0271	-0.0005	-0.0003	0.0143	-0.0607	-0.0710
August	-0.2061	-0.1424	-0.1216	-0.2115	-0.1824	-0.1331	-0.1725
September	-0.0156	-0.2452	-0.1644	-0.1091	-0.1290	-0.1995	-0.1235
October	0.2253	-0.0936	0.0277	0.0793	0.1306	-0.0132	0.0814
November	0.0135	0.1110	0.0225	-0.0050	0.1231	0.0316	-0.0681
December	0.1053	0.1326	-0.0369	0.2799	0.1869	0.3573	0.1733

Table 4: Stochastic Dominance Comparisons of January Returns with non-January Returns

Hong Kong	Jul $>_1$ Jan
Taiwan	-
Japan	-
Malaysia	-
Singapore	Jul $>_2$ Jan Nov $>_2$ Jan Dec $>_2$ Jan
Indonesia	-
Thailand	-

Note: - denotes FSD, SSD & TSD do not exist; $X >_1 Y$ is X dominates Y at FSD, SSD & TSD; $X >_2 Y$ is X dominates Y at SSD & TSD.